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**The Role of New Information Management Technologies in Meeting the
Health Care Needs of Elderly Patients and Determining
Appropriateness for Long-term Care: A Veterans Health
Administration Perspective**

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Introduction

Over the past 50 years, an unexpected change has taken place in the health and social care needs of the elderly population in the US. This group's mortality rate has decreased by 1% year on year¹. In addition to increased life expectancy, the health status of elders is improving as evidenced by diminishing rates of nursing home usage of 0.7% annually² with lower bed occupancy³ rates. These elders have disability reductions of 2% per year^{4,5,6}. A number of causal factors⁵ may explain these findings, including reconfigurations of health care services, changes in health-related behaviors, use of assistive aids, improved socioeconomic status, different expressions of diseases, and increases in levels of social support. Consequently, the elderly population in the US will increase⁷ by 1.5% annually for the over 65's and 2.2% for the over 85's. This makes future long-term care requirements uncertain⁸.

Increasingly, elders are likely to live independently in their homes or in assisted living facilities instead of in institutional care settings and their health care needs will be more difficult to meet^{9,10}. These trends are already impacting a health care system that the Institute of Medicine (IOM) considers cares inadequately for the rising prevalence of people with chronic diseases because of poor coordination of care and reluctance to implement new information technologies¹¹. Another trend is the mounting pressure from these patients and their immediate caregivers for more involvement in health care decisions that affect them.

Advocacy groups are concerned about long-term care and want people with disabilities to be more involved in how services are configured^{12,13}. These consumer demands, coupled with evidence that elderly patients with cognitive deficits can express their preferences¹⁴ for treatment, are prompting some state programs to reconfigure how

they provide long-term care services toward models of independent living¹⁵.

Implementing these models challenges the usual way investment decisions between health care sectors are apportioned¹⁶ by providers of elder care. Consumerism highlights how long-term care delivery systems don't distinguish between meeting need, want, and demand¹⁷. The way practitioners usually assess health needs of patients creates inconsistent variations, as in decisions made about where patients should die¹⁸. When practitioners gauge the preferences of their patients in a paternalistic way it can encourage supplier-induced demand¹⁹. The multiplicity of clinical and financial considerations that drive the long-term care sector confounds efforts to introduce a more patient-focused orientation to delivering these services and perpetuates the fragmentation of care.

Individual patients respond differently if asked to express a preference for various treatment options based on the likely outcomes that may result. Patients want to be involved in choices about their care,²⁰ but operationalizing this is complicated,²¹ for example, when physicians frequently misinterpret their patient's preferences²² about end-of-life issues. An environment of evidence-based practice that gives patients access to relevant information helps them manage uncertainty and fosters shared decision-making. Evidence of clinical effectiveness is a negotiable currency that patient and practitioner can use when the decision-making process is shared. However, patients must be able to interpret the evidence they are given, otherwise it perpetuates the system whereby practitioners arbitrate on the nature, timing, and place of any care being considered. Evidence-based care should mean that decisions affecting patients are made according due weight to all valid and relevant information²³ and is conducive to shared-decision

making. It also focuses attention on systems of care and how their component processes are coordinated across a wider continuum. Studies of medical errors show that health care systems fail at multiple points, rather than from a fault in any one individual constituent part^{24,25}. A systems approach to providing long-term care services needs to incorporate patient preferences, assess patient's health care needs, and ensure the safe and efficient provision of care for chronic diseases. The purpose of this paper is to assess how new information management technologies (IMT) help make this possible.

Computerized Record Systems

IMT, in the form of computerized record systems²⁶ (CRS), record data that is relevant to patient care decisions in discrete data "fields" that are accessible from within searchable databases. The CRS offers a mechanism to analyze systems of care and accord due weight to all valid and relevant information that includes the patient's perspective. From these data inferences can be made about the quality of health care decisions in routine clinical practice and for research purposes. Reliable and robust outcomes measurement requires that validated input and output measures are corroborated with standardized clinical processes, which may include assessing patient preferences. Without a direct causal link between process and outcome, no meaningful inferences can be made about health care delivery. The bar code medication system used in the Department of Veterans Affairs (VA) is linked with community mail order pharmacies (CMOPs)²⁷ and fills over 87 million prescriptions annually. Because systems such as this link process to outcome, they have substantially reduced medication errors,²⁸ as well as satisfying patient preferences in the form of more rapid dispensing of prescriptions and obviating the need to travel to a pharmacy. Creating such IMT tools in large integrated

health care systems requires data tracking and storage systems that take the form of data warehouses. These warehouses are repositories where data is kept in a subject-oriented, integrated, time-variant, and non-volatile manner to facilitate decision support²⁹ systems).

Having data warehouses in health care systems means that data from the CRS³⁰ can be systematically analyzed using data mining techniques³¹. The conjunction of the CRS with data warehousing, clinical decision support systems, and data mining techniques makes it possible to track the care of both individual patients and patient populations throughout a health care system. These IMT resources offer ways to manage quality at several levels – individual practitioner, local facility, and system-wide³². They support disease management systems that link process to outcome, and identify ill or “at risk” people within the system. Programs can then be established to optimize the health of discrete populations³³. IMT can therefore directly address the IOM’s concerns about managing chronic conditions, hence the high premium the IOM places on introducing IMT.

These techniques have enabled Kaiser Permanente, an integrated health care system with comparable challenges to VA, to meet population health needs and improve care³⁴ in patients with diabetes and chronic heart failure, both of which affect the elderly. Normalizing blood glucose in diabetic patients reduces end-organ damage, thereby preventing avoidable mortality and morbidity. Population-based strategies for care delivery presume health care costs will be reduced and/or the quality of care improved. An analysis of data warehoused in the 1990’s by a Puget Sound³⁵ health maintenance organization realized these objectives. HbA1C levels were improved in diabetics with

annual cost reductions of between \$685 and \$950 per person because of fewer hospital admissions and specialty care/primary care visits. Cost reductions were not correlated with patients having recognizable complications of diabetes.

By combining a CRS with data warehousing and sophisticated data analysis techniques, event pathways³⁶ can be generated (a device to simultaneously track different health outcomes from various care processes). An event pathway links a clinical event with how that event is managed, the resources necessary to manage it, and the subsequent clinical and financial outcomes. Creating event pathways requires that a CRS is based upon a master patient index that connects data fields and enables data aggregation. Through event pathways the progress of individuals, as well as discrete populations through a health care system can be tracked, analyzed, and managed in ways that maximize health benefits and cost-effectiveness. Such systems are under development in health care systems including VA, and although they have not been systematically evaluated, their use is predicated on auditing health care processes³⁷, reducing medication errors, enabling the consistent use of clinical guidelines, and generating outcomes data.

Telehealth

Telehealth is the delivery of health care when patient and practitioner are separated by geographical distance³⁸. This author's opinion is that a CRS is necessary to offer safe and effective care via telehealth because it provides the relevant history and investigations necessary to make appropriate health care decisions. The co-dependence of telehealth and health informatics creates a multimedia patient record (MMR) that requires robust bi-directional interfaces between image storage systems and hospital information systems³⁹. New telecommunications technologies are making the MMR freely available

across an integrated health care system like VA to support clinical decision-making, within the constraints of required privacy and confidentiality considerations. Practitioners can also interact with patients in their homes via real-time videoconferencing,⁴⁰ and new home telehealth technologies gather disease management and other data from the home including: pulse, temperature, weight, blood pressure, blood glucose, and anticoagulant status.

VA will soon incorporate these data into its MMR and link data that is routinely derived from the home with that from traditional hospital and ambulatory care settings. This will mean that event pathways can be generated across the continuum of care and will enable the management of patients with chronic diseases to be continual rather than episodic (just-in-time rather than just-in-case). Telehealth should therefore be viewed as a set of emerging technologies with ever decreasing cost and increasing functionality that emulates Moore's Law⁴¹ and constantly enters the health care environment.

Systematic reviews of telehealth's effectiveness and cost-effectiveness have been equivocal^{42,43,44} to date and the issues are reminiscent of when the telephone was first introduced into health care in the late 1800's³⁸. When coupled with the CRS, home telehealth offers an exciting new ability to manage chronic diseases that requires ongoing evaluations from the standpoints of effectiveness and cost-effectiveness. The use of computers and telephones to mediate care is a subset of telehealth for which there is accumulating evidence of effectiveness.

A 1997 systematic review of computer and telephone-mediated telehealth⁴⁵ demonstrated positive outcomes. Computerized communication improved the care of diabetic patients. Patients receiving telephone follow-up care showed greater compliance

with cardiac care, screening, pain management, therapy for panic disorder, antituberculous chemoprophylaxis, dental screening programs, and tobacco cessation. Telephone reminders helped patients' compliance with immunization, foot care instructions, medication compliance, and keeping clinic appointments. After-hours telephone-based access to advice reduced hospital use and was a cost-effective way to offer primary care consultations. Computer-assisted telephone interview methodologies were comparable to printed questionnaire screening tools. Cost-effectiveness data was inconclusive, but continuity of care was improved because clinicians could coordinate care directly with their patients. This facilitatory effect on clinician-patient communication needs to be multi-disciplinary and not limited to physician-to-physician interactions.

Telehealth development involves information specialists and technologists as well as health care professionals. As such, it encompasses a wider body of evidence than the traditional health care literature. Current literature frequently views telehealth as being equated with teleconsultation via televideoconferencing. VA's concept of an MMR that incorporates home telehealth data is at the leading edge of the field. For example, associated VHA activities combine this with systematizing the provision of e-health information to patients and providing them with an electronic patient held record (EPHR) and are at the forefront of thinking. Collectively, these tools promise to revolutionize the care of patients with chronic disease and their future needs for long-term care.

A 1994 study of 2,586 people targeted those with arthritis, back pain, high blood pressure, diabetes mellitus, heart disease, smoking, and obesity who were high users of medical services for health promotion and self-management interventions specific to their

problems, and compared them with population controls. Health promotion and self-management interventions reduced the need for physician visits, hospital stays, and the costs of care.

This study pre-dates the Internet, which offers web-based platforms whereby similar health promotion and self-management interventions can now be provided. The Internet gives patients and providers a surfeit of health information, however its quality in terms of impartiality and accuracy is frequently difficult to assess^{46,47}. While 70% of patients would like their physicians to offer recommendations on web-based information, only 5% of physicians regularly offer it⁴⁸. The use of e-health information to support shared decision-making by patients is difficult to systematically study because of selection bias in choosing subjects⁴⁹ and low response rates to surveys⁵⁰. Home telehealth technologies offer a controlled and easily manageable platform to provide education and self-management tools to patients and offer direct access to the health care system when appropriate. The US Department of Health and Human Services considers the electronic personal health record (EPHR) as a fundamental pillar to support future health care developments⁵¹. Patients seem to agree. When surveyed,⁵² 90% of patients believed that doctors do not maintain complete records. VA is in the process of evaluating a patient-held record called MyHealth-e-Vet.

Discussion

IMT in the form of home telehealth is used to treat chronic conditions, including diabetes⁵³, wound care,⁵⁴ and chronic heart failure⁵⁵. VA's forthcoming integration of these technologies into the CRS will also offer the functionality of an MMR into long-term care (LTC) and assisted living facilities (ALF). It will be possible to provide clinical

information on which treatment decisions can be based and to track event pathways in these settings. These clinical decision-making tools will help support people who want to remain in their own home, or in lower acuity settings such as a day center or an AFL instead of a nursing home. Nursing home care is inevitably needed for some patients because of the intensity of care they require. There are others who, for a constellation of reasons, are in a nursing home by default whom IMT can support in an ALF or in their own home. The term “acopia”⁵⁶ has been proposed for this group of people who have difficulties with activities of daily living often related to falls, incontinence, and dementia. IMT must be able to offer solutions to these activities of daily living if it is to have a meaningful impact on LTC provision.

Falls

Estimates⁵⁷ suggest that 30% of people in the US over age 65 fall each year, and half of these subsequently fall again. In 10% of these people a fall causes serious injury, e.g. fractured hip (1%) and other broken bones (5%). Forty percent of these people are hospitalized after a fall and have associated pain and disability for a median of seven months. Therefore, falls in the elderly result in considerable health care costs.

Establishing the reasons for falling at home is difficult, but hospital data⁵⁸ suggest the following predisposing causes: age over 80 years; treatment with benzodiazepines, other psychotropics, or anti-diabetic drugs; receiving over 5 medications; the presence of 3 or more diseases; cognitive impairment; and a hospital stay beyond 17 days. These data suggest the following telehealth devices may reduce falls in the elderly: alarm/alerting devices, disease management protocols for diabetes, medication compliance devices, and medication management via CRS. IMT and telehealth can identify patients who are at

risk of falling at home or in AFL's and target them for specific interventions and also collect data to determine exactly why elders fall at home.

Incontinence

As the population of people living into extreme old age rise exponentially in the US, the prevalence of urinary incontinence (UI) rises⁵⁹ and causes people to transition from independent living to LTC. In people over 75 years of age, cognitive deficits and impaired mobility make UI problematic to assess, manage, and treat. UI assessments may not lead to a cure but may lessen symptoms, improve quality of life, and prevent costly complications of poorly managed incontinence. The preference⁶⁰ of nurses, family caregivers, and patients is to actively manage UI. Some very frail elderly may respond well to toileting programs such as prompted voiding with, in some cases, the careful addition of a bladder relaxant drug. Patients prefer noninvasive strategies for UI, and preferences for its treatment should be sought from LTC residents and their families. Ongoing assessments, medication management, reminders, and support of the caregiver in the home form a rationale for using telehealth in managing UI. Although telehealth can supplement formal home assessments, research is needed to establish its specific use in managing UI.

Dementia and ADL dependency

Loss of independence from dementia increases as people age and often precipitates a move to LTC. Evidence-based guidelines have been proposed to ameliorate this effect of dementia⁶¹. Examples include medication with cholinesterase inhibitors, vitamin E administration, selegiline, antipsychotics, and antidepressants. Educating family caregivers helps them cope and assist with treatments that can delay nursing home

admission. However, LTC staff should avoid unnecessary use of antipsychotics. Modifying behavior such as scheduled toileting and prompted voiding for UI, and promoting functional independence by graded assistance, skills practice, and positive reinforcement may all help. These are aspects of care that may be provided using telehealth-based support into the home, assisted living facility, or nursing home and can reduce acute in-patient psychiatric care admissions⁶². As cognitive impairment increases, ADL dependency and resource use⁶³ also rise, and telephone assessments of dementia patients offer valuable information on a patient's cognitive function⁶⁴ to help plan care. Comprehensive models that use telehealth to sustain patients with dementia at home have not been described or studied.

Optimizing care

Most health care organizations lack a CRS and cannot gather critical data needed using telehealth to manage patients at home and in ALFs who are at risk of losing their independence from falls, incontinence, and dementia. VA is in a unique position to do so and to perform the necessary outcome studies. Telehealth enables clinical expertise to “virtually” travel to where the patient resides and avoids the risks of disorientation and exposure to infection associated with hospital-based care. A systematic review of current models of geriatric care⁶⁵ for elderly patients that included the frail elderly, functionally-impaired patients at risk for nursing home placement, those suffering recent strokes, hospitalized patients with one or more chronic illness, medically stable inpatients, and patients living at home with impaired function, showed interesting results.

Acute geriatric units do not affect mortality rates or rates of institutional care admission. Post-acute geriatric evaluation and management (GEM) units that focus on rehabilitation and restoration of independent functioning reduce mortality, improve functional outcomes, and facilitate discharge home. There was no evidence that geriatric consultation services and geriatric day hospitals were effective. Condition-specific management of patients based on age or fragility criteria showed that geriatric interventions are best targeted at specific clinical syndromes associated with significant mortality and burden of illness, but cost data were inconclusive. However, elderly patients often have more than one disease, problems with ADLs, and complex psychosocial problems and there is a need to support the caregiver at home, as well as the patient.

Using IMT to review and manage patients instead of physically transporting them to services that are fragmented obviates the problems highlighted by the IOM report. The complexity and multi-disciplinary nature of care means that expert systems are not able to help patients determine if, when, where, and how care should take place. A primary person is still required to interact with the patient or family caregiver to provide this support. The benefits of telehealth arise from reconfiguring health care services around the technology to increase quality and/or reduce costs. Future trends in health care professional employment⁶⁶ mean these reconfigurations are exploring other solutions that reduce the need for health care professionals, for example to administer medications in ALFs⁶⁷. The move of care into non-institutional settings creates a role for health care professionals in coordinating care and helping patients make health care decisions.

Case management and care coordination

Case managers help support patients as they traverse the continuum of care and negotiate with the range of providers they encounter, but the case manager role remains poorly defined⁶⁸ and has not been definitively evaluated across the range of conditions that affect the elderly. A 1995 systematic review⁶⁹ of case management in a mental health population concluded that it could markedly reduce hospital stay and patients were satisfied. They were able to engage with services and access social networks when case management was a direct, clinical service with high staff/patient ratios, and it improved compliance with medication and appointments. Coordinating services for terminally ill cancer patients⁷⁰ using case management was more cost effective than conventional care and achieved the same outcomes, with less need for acute hospital stay. VA has recently married the benefits of case management and the benefits of IMT by creating the concept of care coordination, with a specific focus on supporting LTC needs of elderly veterans.

VA defines care coordination as:

“The ongoing monitoring and assessment of selected patients using telehealth technologies to proactively enable prevention, investigation, and treatment that enhances the health of patients and prevents unnecessary and inappropriate utilization of resources. Care coordination uses best practices derived from scientific evidence to bring together health care resources from across the continuum of care in the most appropriate and effective manner to care for the patient.”

A VA evaluation of care coordination in an elderly population produced dramatic results. This was an intervention study with matched controls in a population of 1,500 patients with chronic diseases that included diabetes, chronic heart disease, post-

traumatic stress disorder, wound care, and spinal cord injury. An economic analysis of the intervention⁷¹ showed a 40% reduction in emergency room visits, 64% reduction in nursing home visits, and 80% reduction in bed days of care. Further, patients were 77% less likely to be admitted to a nursing home.

VA has systematized the clinical processes associated with care coordination through studies and evaluations (e.g. working with the National Cancer Institute to develop a model of cancer care at home). Care coordination enhances the role of the practitioner and means that patient care can be managed by whoever is the primary point of contact with the patient in an interdisciplinary team. IMT support for care coordination will allow the extension of quality initiatives such as the VA's QUIC program⁷² to extend into LTC and non-institutional settings. Together with the patient-held record and the synchronized provision of e-health information to patients, care coordination promises to revolutionize the delivery of care to veterans and enable patient and caregiver preferences to be incorporated into health care decision-making.

Conclusions

The benefits of IMT, including the computerized patient record and telehealth, have not been formally evaluated, yet they are being implemented into health care delivery systems for pragmatic reasons associated with delivering care in increasingly constrained circumstances. These technologies are not health care interventions in themselves, but act as mechanisms to facilitate care. Evidence exists that elements of IMT can cost-effectively streamline care and reduce medical errors.

VA is in a unique position to evaluate the use of IMT in LTC and non-institutional settings and establish the business parameters needed to support wider

implementation. The current use of IMT in health care is analogous to how the Internet evolved before 1995. The Internet required the creation of robust systems and processes in academia and the federal government before private industry could adopt it. The demographics of the veteran population, the integrated nature of VA health care delivery, and the challenges of reengineering care provision and incorporating patient preferences places VA in a unique position to implement and evaluate how IMT can support LTC and create clinically cost-effective models. These models can directly benefit veteran patients in the near term, and then extend into the general health care system.

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